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Re. Application No.: 09/242,072
PCT No: PCT/AU96/00442
Title of Invention: „Apparatus for Liquid Purification”
International Filing Date: 05 August 96

Enclosed are:
Amended (first) IPC Claims

The inventor and applicant requests that after a delay of in excess of 1 year
caused mainly by the USPTO, the processing of this application can be
accordingly accelerated.

Many thanks,

Peter Miller

Inventor and Applicant

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Encl: Amended Claims 1-7 and New Claims 8-12
Version 1: according to USPTO regulations
Version 2: corrected version based on Version 1



CLAIMS (final IPC version)

1. (once amended)

A liquid [filtering] purifying apparatus consisting of a container with an internal lower horizontal, pervious base supporting a bed of loose, granular material[;], whereby the base has the form of a filtrate drainage member or chamber fitted with an outlet nozzle for filtrate and an inlet nozzle for backwash fluids[;], and [whereby] the upper part of the container has an inlet connection for contaminated liquid at or above atmospheric pressure and an outlet connection for backwash fluids, [thereby characterized that the] whereby the improvement comprises a container (1) [is] divided [horizontally] at the level of the pervious horizontal base (2), whereby the dependent rim [portions] portion(s) (3) of the top section (5) of the container [5] (1) is [are] movable [in the vertical direction] to facilitate the removal of the bed from the container and whereby the upper part (5) of the container [5] (1) is fitted with an inlet connection for contaminated liquid and the base (2) of the container (1) is fitted with an outlet nozzle for filtrate.

2. (once amended)

A liquid purifying apparatus according to Claim 1 [thereby characterized, that] whereby bed removal means comprising a section of movable web of filter medium (4) is interposed between the pervious horizontal support base (2) and the [vertically] movable dependent rim [portions] portion(s) of the [top section] upper part (5) of the container [5] (1), thus sealing a sections(s) of the web at the periphery in the closed position, whereby in the [raised] opened position the filter bed after the purification operation is transported out of the container [5] (1).

3. (once amended)

A liquid purifying apparatus according to [Claims] Claim 1, [and 2 thereby characterized that] taken alone or in combinaiton] whereby the bed after the purification operation is [discharged] removed to means comprising [into] a bed regeneration device (6), [whereby] where the material of the bed is regenerated and/or cleaned and reactivated after which and before the purification operation, the bed is recycled to the [top] upper part (5) of the container [5] (1) for reuse[;]

or

whereby the bed after the purification operation is [discharged] removed to means comprising [into] a bed regeneration device (6) [whereby] where the material of the bed [is regenerated and/or cleaned and] after regeneration and/or cleaning and reactivation is recycled to the [top] upper part (5) of the container [(5) of the purifying apparatus] (1) during the purification cycle, [for reuse;] whereby the depth of the bed increases incrementally during the cycle of operation.

or

whereby the bed material after regeneration and/or cleaning and reactivation, is first recycled to means comprising a dosing device (7/20) that before the purification operation feeds the entire bed to the [top] upper part (5) of the container [5] (1) [of the purifying apparatus (1);]

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whereby the bed material [after the purification operation is discharged into a bed regeneration device (6), whence,] after regeneration and/or cleaning and reactivation[, the bed material is then] is first recycled [by] to means comprising a dosing device (7/20) from where during the course of the purification operation the said bed material is dosed to the upper part (5) of filter container [(5)] (1), whereby the depth of the bed increases incrementally during the course of the purification operation[;].

[a conically perforated distributor (27) extends over the entire internal upper section of the container (5).]

4. (once amended)

A liquid purifying apparatus [and method] according to [Claims] Claim 3, [1 and 2, thereby characterized, that taken alone or in combination, the bed after the purification operation is discharged into a bed regeneration device (6), whence after regeneration and/or cleaning and activation of the surfaces of the material comprising the bed and before or after being fed to the filter container (5) in advance of the purification operation, the bed material is mixed with a suspension of active material such as bleaching earth, ion-exchange resin, activated carbon, etc., which if necessary has been pretreated with a surface activating medium to enhance its adhesion to the surface of the material comprising the bed;]

whereby the said bed after the purification operation is [discharged into] removed to a bed regeneration device (6), whence[,] after regeneration and/or cleaning and activation of the internal and external surfaces of the material comprising the bed, [it is mixed with active material such as bleaching earth, activated carbon, etc. which is preferably pretreated with a surface activating medium to promote adhesion to the surface of the material comprising the bed and is dosed by a dosing device (7, 20) to the feed of liquid to be purified from a reservoir (10) and thereby mixed in a mixing device (29) with the said feed either before or after entry into the filter container (5) during the purification operation] means (8,19) are provided for mixing the said bed with activated powdered adsorbents before dosing to the feed of liquid to be purified before or after entry into the upper part (5) of the filter container (1) during the purification operation

or

[alternatively,] means (7, 20 and 8, 19) are provided to separately dose the said material comprising the bed and the said [active material are dosed separately by devices (7/20) and (8/20) respectively and mixed before or after being dosed to the liquid to be purified from reservoir 10 with which they are also mixed either before or after entry into the filter container (5).] activated powdered adsorbents to the feed of liquid to be purified before or after entry into the upper part (5) of the filter container (1) during the purification operation.

5. (once amended)

A liquid purifying apparatus according to Claim 3 [and] or 4, [thereby characterized] whereby the dosing devices (7, 20) and/or (8, 19) are controlled by means comprising a microprocessor (15) from input signals from feed and filtrate instrumentation (13, 14).

6. (once amended)

A liquid purifying apparatus [and method] according to Claim [1 and] 2, [thereby characterized, that taken individually or in combination,] whereby the filter web takes the form of an endless belt (4) consisting of a plurality of sections (201, 202, 203) providing different degrees of filtrate quality and/or consisting of different materials[;]

or

the filter web takes the form of an endless belt consisting of a plurality of sections, whereby means (204, 205, 206) are provided for individually removing and replacing each section and automatically locating each section on the pervious, horizontal support base (2) by means of one or more fixed electronic sensors [fixed to the frame of the apparatus] and one or more electronically sensitive inserts (219) in the edges of the belt[8]

or

the filter web takes the form of a [filter] belt, whereby sections of it are used as support and transport means for introducing strips of pre-fabricated filter material from a storage roll(s) (209/10) or cassette(s) 226 located externally to the purification apparatus (1), whereby after location [the strips are fed onto the filter belt by means of a belt-driven roller combination (207) and whereby after a set length of filter material has been fed onto the porous base (2) the strip is cut to size by a slitting device (208), after which] the dependent rim [portions] portion(s) (3) of the upper part (5) of the container [(5)] (1) [are] is lowered onto the strip of filter material and the section of support belt against the pervious, horizontal support base 2[8]

[the filter web takes the form of a filter belt, whereby sections of it are used as support and transport means for introducing strips of pre-fabricated portions of filter material from storage cassettes (226) located externally to the purification apparatus 1 from where single strips of filter medium (211, 212) are mechanically fed by the feeding mechanism (214, 213) and belt-driven roller combination (207) onto the pervious filtrate base (2) after which the dependent rim portions (3) are lowered to seal the strip of filter material and section of support belt against the pervious, horizontal support base (2);]

or

the filter web takes the form of a [filter] belt, whereby [sections] a section(s) of it, sealed by the dependent rim [portions] portion(s) (3), [are used as support for] supports dosed layers of suspension of [filter aid fibres such as cellulose, glass, asbestos, etc. or powders such as as diatomaceous earth, perlite, molecular sieves, etc.] powdered filter aid from [an] external dosing means (11)[, after which the pressure difference between the container (5) and the filtrate chamber (2) is increased with the introduction to the container (5) of liquid to be purified from reservoir (10) and optionally a dosed quantity of a suspension of adsorbent or filter bed material from dosing means (7), whereby the formed layer of filter aid acts as either the primary filter medium or as a support and polishing or security layer for removing any particulate or dissolved matter escaping from the formed or forming bed.]

[means are provided for moving the dependent rim portions of the container (5) vertically, consisting of laterally positioned fluid driven pistons (304) contained in cylinders (215), the

lubricated shafts (307) connected to sectioned concentric cylindrical sleeves (301) extending and fixed to the extremities of transverse beams (308) that in turn actuate thrust shafts (303) acting on the peripheral part of the upper container (5), whereby to ensure the movement of the dependent rim portions in the horizontal position, ring sections of a suitable material such as polytetrafluoroethylene (302) are fixed to the surfaces of the bodies of the fluid driven cylinders (215) and fitted in the annular space between the cylinder surfaces and the internal surfaces of the reciprocating sleeves (301);

the filter web takes the form of a filter belt, whereby the pervious horizontal base (2) supporting a section of the belt consists of a recessed plate (505) containing a plurality of manually removable, belt supporting filtrate drainage members (502) preferably made up of upper perforated sheet material (503) integrated with a lower layer or layers of such materials as woven mesh or expanded sheet material (504), whereby the upper perforated sheet material lies flush with the peripheral sealing portions of the plate (505);

the filter web takes the form of a filter belt, whereby the means in the form of a suitable motor or actuator (702) is provided to reverse the direction of the transport of the belt to discharge the filter bed at either end of the purifying apparatus (1).]

7.(once amended)

A liquid purification apparatus [and method] according to Claim [6] 2, [thereby characterized that taken individually or in combination]

whereby means [in the form of] comprising a gas pressure differential controller (405), a gas flow controller (406) and a gas flow control valve (407) [provided] in a compressed gas conduit (403) leading into the upper [portion] part (5) of the filter container [(5)] (1) [to] control and record the volumetric gas flow into the said container and thereby provide a measure of the rate of filtration of a layer of liquid with known or unknown filtration characteristics lying on a section of sealed filter medium supported by a horizontal pervious support base (2); [6]

means in the form of a programmed microprocessor (15) that receives data from instrumentation such as (405, 406) and/or (13) and/or (14) regarding the filtration characteristics and quality of a liquid processed by the purifying apparatus (1) and chooses and positions the type or types of media and mode of purification and/or filtration to achieve previously manually chosen menu of results;

means in the form of a programmed microprocessor (15) that receives data from instrumentation such as (405, 406) and/or (13) and/or (14) regarding the filtration characteristics of any given section of medium sealed by the container (5) and if necessary automatically initiates a medium regeneration and/or a renewal operation;

means in the form of a gas pressure differential controller (405), a gas flow controller (406) and a gas flow control valve (407) provided in a compressed gas conduit (403) leading into the upper portion of the container (5) to control and record the volumetric gas flow into the said container and thereby provide a measure of the rate of filtration of a layer of liquid with known filtration characteristics lying on a section of sealed filter medium with unknown filtration characteristics supported by a horizontal pervious support base (2);

means in the form of a programmed microprocessor (15) that receives data from instrumentation such as (405, 406) and/or (13) and/or (14) regarding the filtration characteristics and quality of a liquid processed by the purification apparatus (1) and chooses and positions the type or types of media and mode of purification and/or filtration to achieve a previously manually chosen menu of results;

means in the form of a programmed microprocessor (15) that receives data from instrumentation such as (405, 406) and/or (13) and/or (14) regarding the filtration characteristics of any given section of medium sealed by the container (5) and if necessary automatically either initiates a regeneration and/or renewal operation.]

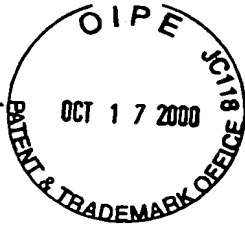
8. A liquid purification apparatus according to Claim 2, whereby means comprising a programmable microprocessor (15) receives data from instrumentation (405, 406) and/or (13) and/or (14) regarding the filtration characteristics and quality of a liquid processed by the purifying apparatus (1) then chooses and positions a type(s) of media and/or initiates a mode of purification to achieve a manually chosen menu of results and/or to initiate a medium regeneration and/or a medium renewal operation.

9. A liquid purification apparatus according to Claim 1, whereby means are provided for moving the dependent rim portion(s) (3) of the upper part (5) of the container (1) vertically, consisting of laterally positioned fluid driven pistons (304) contained in cylinders (215), the bodies of which are fixed to a load-bearing framework (306) with the external extremity of the lubricated shafts (307) connected to sectioned sleeves (301) which extend and are fixed at the upper end to the extremities of transverse beams (308) that in turn actuate thrust shafts (303) acting on the peripheral part of the upper container (5), whereby to ensure the movement of the dependent rim portion(s) in the horizontal position, guide sections (302) are fixed to the surfaces of the bodies of the fluid driven cylinders (215) and fitted in sliding engagement with the internal surfaces of the reciprocating sleeves (301).

10. A liquid purification apparatus according to Claim 2, whereby the section of filter web is supported on a pervious horizontal base (2) consisting of a recessed plate (505) containing one or a plurality of manually removable, web supporting filtrate drainage members (502).

11. A liquid purification apparatus according to Claim 6, whereby the filter belt is provided with an actuator (702) to reverse the direction of the transport of the belt to transport the filter bed to either end of the purifying apparatus (1).

12. A liquid purification apparatus according to Claim 1, whereby the upper part (5) of the container (1) is provided with feed distribution means comprising a conically perforated distributor (27) extending over an internal horizontal section of the upper part (5) of the container (1).



CLAIMS (once amended IPC version)

1. (once amended)

A liquid purifying apparatus consisting of a container with an internal lower horizontal, pervious base supporting a bed of loose, granular material;
whereby the base has the form of a filtrate drainage member or chamber fitted with an outlet nozzle for filtrate and an inlet nozzle for backwash fluids,
and the upper part of the container has an inlet connection for contaminated liquid at or above atmospheric pressure and an outlet connection for backwash fluids,

whereby the improvement comprises

a container (1) divided at the level of the pervious horizontal base (2),
whereby the dependent rim portion(s) (3) of the top section (5) of the container (1) is movable to facilitate the removal of the bed from the container
and whereby the upper part (5) of the container (1) is fitted with an inlet connection for contaminated liquid
and the base (2) of the container (1) is fitted with an outlet nozzle for filtrate.

2. (once amended)

A liquid purifying apparatus according to Claim 1,

whereby bed removal means comprising a section of movable web of filter medium (4) is interposed between the pervious horizontal support base (2) and the movable dependent rim portion(s) of the upper part (5) of the container (1), thus sealing a sections(s) of the web at the periphery in the closed position,
whereby in the opened position the filter bed after the purification operation is transported out of the container (1).

3. (once amended)

A purifying apparatus according to Claim 1,

whereby the bed after the purification operation is removed to means comprising a bed regeneration device (6),
where the material of the bed is regenerated and/or cleaned and reactivated after which and before the purification operation, the bed is recycled to the upper part (5) of the container (1) for reuse

or

whereby the bed after the purification operation is removed to means comprising a bed regeneration device (6) where the material of the bed after regeneration and/or cleaning and reactivation is recycled to the upper part (5) of the container (1) during the purification cycle, whereby the depth of the bed increases incrementally during the cycle of operation

or

whereby the bed material after regeneration and/or cleaning and reactivation, is first recycled to means comprising a dosing device (7/20) that before the purification operation feeds the entire bed to the upper part (5) of the container (1)

or

whereby the bed material after regeneration and/or cleaning and reactivation is first recycled to means comprising a dosing device (7/20) from where during the course of the purification operation the said bed material is dosed to the upper part (5) of filter container (1), whereby the depth of the bed increases incrementally during the course of the purification operation.

4. (once amended)

A liquid purifying apparatus according to Claim 3,
whereby the said bed after the purification operation is removed to a bed regeneration device (6), whence after regeneration and/or cleaning and activation of the internal and external surfaces of the material comprising the bed,
means (8,19) are provided for mixing the said bed with activated powdered adsorbents before dosing to the feed of liquid to be purified before or after entry into the upper part (5) of the filter container (1) during the purification operation

or

means (7, 20 and 8, 19) are provided to separately dose the said material comprising the bed and the said activated powdered adsorbents to the feed of liquid to be purified before or after entry into the upper part (5) of the filter container (1) during the purification operation.

5. (once amended)

A liquid purifying apparatus according to Claim 3 or 4,
whereby the dosing devices (7, 20) and/or (8, 19) are controlled by means comprising a microprocessor (15) from input signals from feed and filtrate instrumentation (13, 14).

6. (once amended)

A liquid purifying apparatus according to Claim 2,
whereby the filter web takes the form of an endless belt (4) consisting of a plurality of sections (201, 202, 203) providing different degrees of filtrate quality and/or consisting of different materials

or

the filter web takes the form of an endless belt consisting of a plurality of sections,
whereby means (204, 205, 206) are provided for individually removing and replacing each section and automatically locating each section on the pervious, horizontal support base (2) by means of one or more fixed electronic sensors and one or more electronically sensitive inserts (219) in the edges of the belt

or

the filter web takes the form of a belt,
whereby sections of it are used as support and transport means for introducing strips of pre-fabricated filter material from a storage roll(s) (209/10) or cassette(s) (226) located externally to the purification apparatus (1),

whereby after location, the dependent rim portion(s) (3) of the upper part (5) of the container (1) is lowered onto the strip of filter material and the section of support belt against the pervious, horizontal support base (2)

or

the filter web takes the form of a belt,
whereby a section(s) of it, sealed by the dependent rim portion(s) (3), supports dosed layers of suspension of powdered filter aid from external dosing means (11).

7. (once amended)

A liquid purification apparatus according to Claim 2 ,
whereby means comprising a gas pressure differential controller (405), a gas flow controller (406) and a gas flow control valve (407) in a compressed gas conduit (403) leading into the upper part (5) of the filter container (1) control and record the volumetric gas flow into the said container and thereby provide a measure of the rate of filtration of a layer of liquid with known or unknown filtration characteristics lying on a section of sealed filter medium supported by a horizontal pervious support base (2).

8. A liquid purification apparatus according to Claim 2,
whereby means comprising a programmable microprocessor (15) receives data from instrumentation (405, 406) and/or (13) and/or (14) regarding the filtration parameters and quality of a liquid processed by the purifying apparatus (1) then chooses and positions a type(s) of media and/or initiates a mode of purification to achieve a manually chosen menu of results and/or to initiate a medium regeneration and/or a medium renewal operation.

9. A liquid purification apparatus according to Claim 1,
whereby means are provided for moving the dependent rim portion(s) (3) of the upper part (5) of the container (1) vertically, consisting of laterally positioned fluid driven pistons (304) contained in cylinders (215), the bodies of which are fixed to a load-bearing framework (306) with the external extremity of the lubricated shafts (307) connected to sectioned sleeves (301) which extend and are fixed at the upper end to the extremities of transverse beams (308) which in turn actuate thrust shafts (303) acting on the peripheral part of the upper container (5), whereby to ensure the movement of the dependent rim portion(s) in the horizontal position, guide sections (302) are fixed to the surfaces of the bodies of the fluid driven cylinders (215) and fitted in sliding engagement with the internal surfaces of the reciprocating sleeves (301).

10. A liquid purification apparatus according to Claim 2,
whereby the section of filter web is supported on a pervious horizontal base (2) consisting of a recessed plate (505) containing one or a plurality of manually removable, web supporting filtrate drainage members (502).

11. A liquid purification apparatus according to Claim 6,
whereby the filter belt is provided with an actuator (702) to reverse the direction of the transport of the belt to transport the filter bed to either end of the purifying apparatus (1).

12. A liquid purification apparatus according to Claim 1,

whereby the upper part (5) of the container (1) is provided with feed distribution means comprising a conically perforated distributor (27) extending over an internal horizontal section of the upper part (5) of the container (1).